

I claim:

1. An apparatus for driving a threaded shaft assembly comprised of a threaded shaft with an axis of rotation and, engaged therewith, a threaded nut, wherein:

(a) said assembly comprises means for subjecting said threaded nut to ultrasonic vibrations and thereby causing said threaded shaft to simultaneously rotate and translate in the axial direction,

(b) said threaded shaft is operatively connected to a load, and

(c) said assembly also is comprised of means for applying an axial force to said threaded shaft.

2. The apparatus as recited in claim 1, wherein said assembly comprises means for moving said threaded nut in an orbital direction.

3. The apparatus as recited in claim 1, wherein said threaded nut is a substantially rigid body.

4. The apparatus as recited in claim 1, further comprising a housing in which said threaded shaft assembly is disposed.

5. The apparatus as recited in claim 4, wherein said threaded nut is attached to said housing.

6. The apparatus as recited in claim 5, wherein said housing has a first bending resonant frequency in excess of 20,000 cycles per second, and wherein the first bending mode lies in a plane parallel to said axis of rotation.

7. The apparatus as recited in claim 6, wherein said housing has a second bending resonant frequency that is identical to said first bending resonant frequency, and wherein the second bending mode lies in a plane orthogonal to said first bending mode.

8. The apparatus as recited in claim 6, further comprising means for orbiting said threaded nut at a frequency of at least about 20,000 orbits per second.

9. The apparatus as recited in claim 8, further comprising means for moving said threaded shaft in a direction substantially parallel to said axis of rotation.
10. The apparatus as recited in claim 8, further comprising means for rotating said threaded shaft while moving said threaded shaft in a direction substantially parallel to said axis of rotation.
11. The apparatus as recited in claim 7 wherein said means for orbiting said threaded nut is comprised of at least two transducers for changing electrical energy into force.
12. The apparatus as recited in claim 11 wherein said transducers are selected from the group consisting of piezoelectric transducers, electrostrictive transducers, magnetostrictive transducers, electostatic transducers, electromagnetic transducers, and mixtures thereof.
13. The apparatus as recited in claim 12 wherein said transducers are piezoelectric transducers.
14. The apparatus as recited in claim 13, wherein said piezoelectric transducers are piezoelectric plates.
15. The apparatus as recited in claim 14, wherein said piezoelectric plates are comprised of piezoelectric material with a dielectric loss factor of less than about 1 percent at a frequency greater than about 20,000 Hertz.
16. The apparatus as recited in claim 14, wherein said piezoelectric plates are comprised of piezoelectric material with a dielectric loss factor of less than about 0.5 percent at a frequency greater than about 20,000 Hertz.
17. The apparatus as recited in claim 1, wherein said threaded shaft is comprised of a multiplicity of threads with a thread pitch of from about 40 to about 250 threads per inch.
18. The apparatus as recited in claim 1, wherein said threaded shaft is disposed within a housing, and wherein said threaded shaft is connected to a knob.

19. The apparatus as recited in claim 18, further comprising a movable stage connected to said threaded shaft and to said housing.

20. An apparatus comprised of at least two movable stages that are contiguous with each other, wherein each of said at least two movable stages is comprised of the apparatus of claim 19.